



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/695,553	10/28/2003	Young-Nam Hwang	5649-1195	5476

20792 7590 02/15/2005

MYERS BIGEL SIBLEY & SAJOVEC
PO BOX 37428
RALEIGH, NC 27627

EXAMINER

LEE, HSIEN MING

ART UNIT	PAPER NUMBER
----------	--------------

2823

DATE MAILED: 02/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/695,553

Applicant(s)

HWANG ET AL.

Examiner

Hsien-ming Lee

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-43 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 6, 7, 11, 12, 15-17, 20, 21, 25-27, 30, 34, 37 and 41 is/are rejected.
- 7) ☒ Claim(s) 4, 5, 8-10, 13, 14, 18, 19, 22-24, 27-29, 31-33, 35-40, 42 and 43 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>070604 & 092904</u> | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 6, 7, 11, 12, 15-17, 20-21, 25-27, 30, 34, 37 and 41 are rejected under 35 U.S.C. 102(e) as being anticipated by Lowrey (US 6,764,894).

In re claim 1, Lowrey, in Fig.1 and related text, teaches the claimed device, comprising:

- a substrate 12/16;
- a lower electrode 22 disposed on the substrate 12/16;
- a phase changeable pattern 28 disposed on the lower electrode 22; and
- an upper electrode 30 disposed on the phase changeable pattern 28 and having a tip that extends therefrom and is directed toward the lower electrode 22.

In re claim 2, Lowrey, in Fig.1, teaches an interlayer insulating film 32/26 disposed on the substrate 12/16 and having an opening therein that exposes at least a portion of the lower electrode 22 and wherein the phase changeable pattern 28 is formed in the opening and has a depression therein that is directed toward the lower electrode 22.

In re claim 3, Lowrey teaches spacers 24 disposed between opposing sidewalls of the interlayer insulating film 32/26 and the phase changeable pattern 28 in the opening.

In re claim 6, Lowrey teaches a phase changeable memory device, comprising:

Art Unit: 2823

- a substrate 12/16;
- a lower electrode 22 disposed on the substrate 12/16;
- an interlayer insulating film 32/26 disposed on the substrate 12/16 having an opening therein that exposes at least a portion of the lower electrode 22;
- a spacer pattern 24 disposed on sidewalls of the opening;
- a phase changeable pattern 28 disposed on the lower electrode 22 in the opening and extending on the interlayer insulating film 32/26; and
- an upper electrode 30 disposed on the phase changeable pattern 28 and having a tip that extends therefrom and is directed toward the lower electrode 22.

In re claims 7 and 12, Lowrey teaches that the phase changeable pattern 28 has a depression therein that is directed toward the lower electrode 22.

In re claim 11, Lowrey teaches a phase changeable memory device, comprising:

- a substrate 12/16;
- a lower electrode 22 disposed on the substrate 12/16;
- an interlayer insulating film 32/26 disposed on the substrate 12/16 having an opening therein that exposes at least a portion of the lower electrode 22;
- a spacer pattern 24 disposed on sidewalls of the opening;
- a phase changeable pattern 28 disposed on the lower electrode 22 in the opening 6;
- and
- an upper electrode 30 disposed on the phase changeable pattern 28 and extending on the interlayer insulating film 32/26, the upper electrode 30 having a tip that extends therefrom and is directed toward the lower electrode 22.

Art Unit: 2823

In re claim 15, Lowrey teaches a method of forming a phase changeable memory device, comprising:

- providing a substrate 12/16;
- forming a lower electrode 22 disposed on the substrate 12/16;
- forming a phase changeable pattern 28 on the lower electrode; and
- forming an upper electrode 30 on the phase changeable pattern 28 that has a tip that extends therefrom and is directed toward the lower electrode 22.

In re claim 16, Lowrey teaches forming an interlayer insulating film 32/26 on the substrate 12/16 that has an opening therein that exposes at least a portion of the lower electrode 22; and wherein forming the phase changeable pattern 28 comprises forming the phase changeable pattern 28 in the opening so as to have a depression therein that is directed toward the lower electrode 22 (Fig. 1).

In re claim 17, Lowrey teaches forming a spacer 24 between opposing sidewalls of the interlayer insulating film 32/26 and the phase changeable pattern 28 in the opening.

In re claims 20 and 25, Lowrey, in Fig. 1, teaches a method of forming a phase changeable memory device, comprising:

- providing a substrate 12/16;
- forming a lower electrode 22 on the substrate 12/16;
- forming an interlayer insulating film 32/26 on the substrate 12/16 that has an opening therein that exposes at least a portion of the lower electrode 22;
- forming a spacer pattern 24 on sidewalls of the opening;

Art Unit: 2823

- forming a phase changeable pattern 28 on the lower electrode in the opening and extending on the interlayer insulating film 32/26; and
- forming an upper electrode 30 on the phase changeable pattern 28 and extending on the interlayer insulating film 32/26, the upper electrode 30 having a tip that extends therefrom and is directed toward the lower electrode 22.

In re claims 21, 26 and 27, Lowrey teaches that the phase changeable pattern 28 has a depression therein that is directed toward the lower electrode 22.

In re claim 30, Lowrey, in Fig. 1, teaches a method of forming a phase changeable memory device, comprising:

- providing a substrate 12/16;
- forming a lower electrode 22 on the substrate 12/16;
- forming an interlayer insulating film 32/26 on the substrate 12/16 and the lower electrode 22;
- patterning the interlayer insulating film 32/26 to form a contact hole that at least exposes a portion of the lower electrode 22;
- forming a spacer pattern 24 on sidewalls of the contact hole;
- forming a phase changeable material 28 in the contact hole on the lower electrode 22 (Fig. 2I), the phase changeable material 28 having a depression therein that is directed toward the lower electrode 22;
- forming a conductive film 30 on the phase changeable material 28 (Fig. 2I); and
- patterning the conductive film 30 and the phase changeable material 28 to form an upper electrode 30 and a phase changeable pattern 28, respectively (Fig. 1).

Art Unit: 2823

In re claim 34, Lowrey teaches that the conductive film 30 fills the depression of the phase changeable material 28 to form a tip toward the lower electrode 22 (Fig.1).

In re claim 37, Lowrey, in Fig.1, teaches a method of forming a phase changeable memory device, comprising:

- providing a substrate 12/16;
- forming a lower electrode 22 on the substrate 12/16;
- forming an interlayer insulating film 32/26 on the lower electrode 22 and the substrate 12/16;
- patterning the interlayer insulating film 32/26 to form a contact hole that at least exposes a portion of the lower electrode 22;
- forming a spacer pattern 24 on sidewalls of the contact hole;
- forming a phase changeable pattern 28 in the contact hole on the lower electrode 22, the phase changeable pattern 28 having a depression therein that is directed toward the lower electrode 22;
- forming a conductive film 30 on the phase changeable pattern 28 (Fig.2I); and
- patterning the conductive film 30 to form an upper electrode 30.

In re claim 41, Lowrey teaches that the conductive film 30 fills the depression of the phase changeable pattern 28 to form a tip toward the lower electrode 22 (Fig.1).

3. Claims 1 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Xu (US 6,566,700).

In re claim 1, Xu, in Fig.1 and related text, teaches the claimed device, comprising:

- a substrate 12;

Art Unit: 2823

- a lower electrode 14 disposed on the substrate 12;
- a phase changeable pattern 24 disposed on the lower electrode 14; and
- an upper electrode 26 disposed on the phase changeable pattern 24 and having a tip that extends therefrom and is directed toward the lower electrode 14.

In re claim 15, Xu teaches a method of forming a phase changeable memory device, comprising:

- providing a substrate 12;
- forming a lower electrode 14 disposed on the substrate 12;
- forming a phase changeable pattern 24 on the lower electrode 14; and
- forming an upper electrode 26 on the phase changeable pattern 24 that has a tip that extends therefrom and is directed toward the lower electrode 14.

Double Patenting

4. Claim 27 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 26.

When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Objections

5. Claim 37 is objected to because of the following informalities: in-consistent term, i.e. “phase changeable pattern” (line 8 in claim 37) versus “phase changeable material” (line 11 in claim 37). Appropriate correction is required.

Allowable Subject Matter

6. Claims 4, 5, 8-10, 13, 14, 18, 19, 22-24, 28, 29, 31-33, 35, 36, 38-40, 42 and 43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record, either alone or combination, neither teaches nor suggests an *etch stop* disposed between the interlayer insulating film and the lower electrode (claims 4, 9, 13, 18, 23, 28, 31, 38); a *shield layer* disposed on sidewalls of the phase changeable pattern (claims 5, 8, 19, 22, 36 and 43); a *plate electrode* electrically connected to the upper electrode (claims 10, 14, 24, 29, 35 and 42); patterning the interlayer insulating film to expose etch stop layer (claims 32, 39); the phase changeable material layer is thicker than half of a minimum width of a lower portion of the contact hole (claim 33); and *chemical mechanical polishing the phase changeable material* to expose the interlayer insulating film (claim 40).

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Dennison et al. to US 6,605,527 (Fig. 16) and Hudgens et al. to US 6,507,061 (Fig. 1) at least read on claims 1, 6, 11, 15, 20, 25, 30 and 39.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on Tuesday-Thursday (8:00 ~ 6:00).

Art Unit: 2823

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hsien-ming Lee
Primary Examiner
Art Unit 2823

Feb. 9, 2005

HSIEN-MING LEE
PRIMARY EXAMINER

[Signature]
2/9/2005